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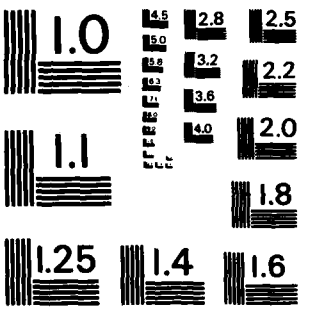

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

* * *

OPERATING
and
SUPPORT

COST ESTIMATING GUIDE

SAMPLE ANALYSIS
MICROWAVE LANDING SYSTEM AT DSARC III

* * *

Office of the Secretary of Defense
Cost Analysis Improvement Group

1 January 1980

FORWARD

DOD Directive 5000.4 "OSD Cost Analysis Improvement Group", provided the charter for the Cost Analysis Improvement Group (CAIG) to review and establish criteria, standards, and procedures concerning the preparation and presentation of cost estimates on defense systems to the DSARC and CAIG. In support of this objective, the CAIG has periodically issued guidance for development and presentation of Operating and Support (O&S) cost for OSD review. To date general guidance has been made available for aircraft, ships, and ground combat vehicles.

In consonance with that general guidance, the following sample of a CAIG Operating and Support Cost Estimate Report covering a hypothetical case has been developed to further assist the cost analyst in the preparation of cost estimating reports submitted to the DSARC and CAIG during the acquisition process of a new weapon system.

This sample is not intended to imply the existence of a specific acquisition program. Nor does it imply a preference for one analysis technique over another. The sample is intended to show an example of how Operating and Support Costs can be developed for CAIG review with available data bases and one example of an appropriate format for presentation of cost estimates.

The existing data was used only to illustrate the need to relate an estimate to an existing similar system and to ensure a constant relationship between values and the Cost Element Structure. It is not used to promulgate the use of specific data bases. Each case should address that data which is the most complete and accurate for its purposes. Further, the level of detail depicted in this example may be greater or less than that which is available or appropriate to a specific case.

EXECUTIVE SUMMARY

Operating and Support (O&S) costs for the Micro Wave Landing System (MLS) and the current Precision Approach Radar/Instrument Landing System (PAR/ILS) (baseline) are shown below. These figures are compared to the figures presented to the DSARC at Milestone II.

O&S Cost
DSARC II to DSARC III Comparison
FY 80 $ - Millions

	DSARC II		Current Estimate	
	PAR/ILS	MLS	PAR/ILS	MLS
$/Installation/yr	1.5	0.8	1.5	0.6
$/System/yr	225	116.3	228.5	95.6
20 Year Life Cycle Cost	5062.5	2869.6	5141.8	2152.2

The force O&S costs are based on a three year delivery schedule plus 20 years of full force operation of 150 copies. . . .

The cost reduction reflects a drop in the number of support personnel by 3. This cost reduction occurred in spite of the rapid rise in energy costs. The automatic solid state MLS requires only about 66% of the energy of the existing PAR/ILS in spite of an added automatic communications capability . . . .

GUIDANCE: THE EXECUTIVE SUMMARY IS A SIMPLE ONE PAGE NARRATIVE PROVIDING THE BOTTOM LINE COSTS, FORCE SIZE AND MAJOR COSTS DRIVERS, AND ASSUMPTIONS. INCLUDE A BRIEF EXPLANATION OF DIFFERENCES PREDICTED FROM THE BASELINE SYSTEM AND THE DSARC MILESTONE II COST ESTIMATIONS.

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1. INTRODUCTION

The following cost analysis report is submitted in support of Defense Systems Acquisition Review Council (DSARC) Milestone III review of the Microwave Landing System . . . . All values included in this report are in FY 80 dollars unless indicated otherwise.

GUIDANCE: IDENTIFY THE MILESTONE MISSION ELEMENT NEEDS STATEMENT (MENS) AND DECISION COORDINATING PAPER (DCP) WITH DATE AND THE BASE YEAR FOR COSTS IN THE INTRODUCTION.

The existing Ground Controlled Approach (GCA) Precision Approach Radars (PAR), and Instrument Landing Systems (ILS), although adequate for safety of flight, are not in conformance with the international standard, nor do they provide the requisite training medium for wartime deployments . . . .

GUIDANCE: INCLUDE A SHORT STATEMENT SUMMARIZING THE MENS/DCP AND ANY SIGNIFICANT DEVIATIONS THAT THE COST ANALYSIS MAKES FROM THE DOCUMENTS.

The objective of this program is to provide an automated system for local air traffic management which is in conformance with international guidelines. This will provide for increased control and safety, and be deployable under wartime conditions . . . .

The MLS has been installed on a number of non-U.S. military facilities. Its operation has shown a 99.9% availability with the minimum amount of preventative maintenance . . . . The high reliability was achieved through built in redundency, alternate path circuitry, and self-corrective trouble shooting . . . . The use of modular components throughout the MLS has . . . . A mean time to repair objective of ___ hours is supported by the experience of existing civilian facilities . . . .

Potential risk is considered minimal since the system is currently operating under field conditions at . . . . and the proposed system is an "off the shelf" item . . . . A picture of the MLS installed at . . . is provided as Figure 1 . . . .

GUIDANCE: ALSO, OUTLINE THE PROGRAM, ITS STAGE OF DEVELOPMENT, MAJOR SYSTEM PARAMETERS, AND MAJOR POTENTIAL RISKS THAT IMPACT OPERATING AND SUPPORT (O&S) COSTS.

Table 1 presents the Operating and Support (O&S) costs for the MLS and the combined PAR and ILS. The data is shown for the total facilities which will be included in the MLS and are normalized for an entire year's operation . . . .

In Table 2 the cost estimates presented at DSARC II and DSARC III are tracked to the current estimate and reasons for significant variances given . . . .

Table 3 presents the O&S costs for the life cycle of the MLS with the preferred procurement delivery schedule as listed in the Decision Coordinating Paper (DCP) for the MLS dated . . . .

These costs are based on a mature system operating for a full year. To account for non-operating time due to delivery and installation schedules, all systems installed within a given year are assumed to accrue O&S costs for only half of the year of installation.

GUIDANCE: THE TABLE LISTING THE O&S ANNUAL COSTS FOR A TYPICAL UNIT SHOULD REFLECT THE COST ELEMENT STRUCTURE (CES) ARRIVED AT THROUGH CONSULTATION WITH THE COST ANALYSIS IMPROVEMENT GROUP (CAIG). THE COSTS SHOULD ALSO BE COMPARED TO THOSE PRESENTED TO THE DSARC AT MILESTONE II AND THE COSTS DIFFERENTIALS EXPLAINED. THE O&S COSTS SHOULD ALSO BE PRESENTED BY FISCAL YEAR. THESE FIGURES SHOULD BE IDENTICAL TO THE FIGURES PRESENTED IN THE INTEGRATED PROGRAM SUMMARY (IPS) WITH THE DELIVERY SCHEDULES FOR EACH ALTERNATIVE IDENTIFIED IN THE DECISION COORDINATING PAPER (DCP).

ARTIST'S RENDITION

Figure 1. MICROWAVE LANDING SYSTEM

TABLE 1. TYPICAL ANNUAL OPERATING AND SUPPORT COSTS
(THOUSANDS, FY80$)

Cost Element	PAR/ILS	Baseline	MLS	Estimate
Unit Mission Personnel		$825		$257
Operators	265		-	
Maintenance	454		212	
Support	106		45	
Unit Level Consumption		$109		$73
Energy	26		17	
Maintenance Material	83		56	
Depot Level Maintenance		$135		$150
Equipment Overhaul[1]	-		-	
Component Repair[2]	85		95	
Support Equipment	-		-	
Modification	-		-	
Contract Unit Level Support	50		55	
Sustaining Investment		$17		$18
Reparable Spares[2]	17		18	
Replacement Support-Equip	N/A		N/A	
Modification Kits	N/A		N/A	
Other Recurring Investment	-		-	
Installation Support Personnel		$149		$46
Base Operating Support	119		37	
Real Property Management[3]	17		5	
Medical	13		4	
Indirect Personnel Support		$82.5		$27
Misc Operations Maintenance	51.5		17	
Medical O&M (Non-Pay)	10.5		3.5	
Permanent Change of Station	20.5		6.5	
Temporary Additional Duty Pay	N/A		N/A	
Depot Non-Maintenance				N/A
General Depot Support	N/A		N/A	
Second Dest. Transportation	N/A		N/A	
Personnel Acquisition & Training		$206		$66.5
Acquisition	29.5		9	
Individual Training	176.5		57.5	
TOTAL		$1523.5		$637.5
System Cost (x150 locations)	$228,525		$95,625	

TABLE 2. DSARC II TO DSARC III COMPARISON
ANNUAL OPERATING AND SUPPORT COSTS
(THOUSANDS, FY80$)

	Current	Est	DSARC II	Est	Change	Comments
Unit Mission Personnel		$257		$302	-45	
Operators	-		-		-	
Maintenance	212		212		0	
Support	45		90		-45	4
Unit Level Consumption		$73		$73	0	
Energy	17		17		0	
Maintenance Material	56		56		0	
Depot Level Maintenance		$150		$150	0	
Equipment Overhaul[1]	95		95		0	
Component Repair[2]	-		-		-	
Support Equipment	-		-		-	
Modifications	-		-		-	
Contract Unit Level Spt	55		55		0	
Sustaining Investment		$18		$18	0	
Reparable Spares[2]	18		18		0	
Replaceable Spt. Equip.	N/A		N/A		-	
Modifications Kits	N/A		N/A		-	
Other Recurring Invest	-		-		-	
Installation Spt Personnel		$46		$54	-8	
Base Operating Support	37		43		-6	
Real Property Management[3]	5		6		-1	
Medical	4		5		-1	
Indirect Personnel Support		$27		$35	-8	
Misc Operations & Maintenance	17		21		-4	
Medical O&M (Non-Pay)	3.5		5		-1.5	
Permanent Change of Sta.	6.5		9		-2.5	
Temp Add Duty Pay	N/A		N/A		-	
Depot Non-Maintenance						
General Depot Support	N/A		N/A		-	
Second Dest. Transportation	N/A		N/A		-	
Personnel Acquisition & Trng		$66.5		$143	-76.5	
Acquisition	9		72		-63	4
Individual Training	57.5		71		-13.5	4
TOTAL		$637.5		$775	-137.5	
System Cost (x150 locations)	95,625		$116,250			

Notes on Tables 1 and 2

1. Equipment overhaul is included under on-site Contract Unit Level Support which includes the contractor's technical representative.

2. Historical data indicates that the cost of replenishment spares is approximately 20% of the component repair costs.

3. Included in Base Operating Support.

4. Decrease due to reduction of 3 support personnel as result of DSARC directed analysis.

GUIDANCE: IN THE ESTIMATION OF MAINTENANCE COSTS, CARE MUST BE EXERCISED TO DEVELOP A METHODOLOGY THAT WILL CAPTURE ALL COSTS INVOLVED IN THE MAINTENANCE SYSTEM OF THE PARTICULAR SERVICE. IN PARTICULAR, THE I AND D LEVEL MAINTENANCE FACE THE REPAIR OR REPLACE DECISION. THESE ACTIONS FALL INTO THE COMPONENT REPAIR AND REPLENISHMENT SPARES CATEGORIES. A SIMILAR FUNCTION INVOLVES SUPPORT EQUIPMENT REPAIR AND REPLACEMENT.

THE CAPTURING OF THESE COSTS CAN BE DONE IN A VARIETY OF WAYS. IT IS HIGHLY LIKELY THAT A SITE SURVEY METHOD WILL BE REQUIRED FOR C^3I SYSTEMS BECAUSE THE MAINTENANCE COSTS GENERALLY CALCULATED IN STANDARD DATA BASES ALLOCATE MAINTENANCE ACTIONS TO THE T/M/S OR M/D/S WHICH USE THEM. THIS ACTION ALSO ALLOCATES COSTS OF REPAIRING COMPONENTS WHICH DID NOT COME FROM AIRCRAFT BUT WHICH ARE USED ON GROUND EQUIPMENT.

THE SITE SURVEY METHOD WILL PROBABLY BE DIRECTED TOWARD ESTABLISHMENT OF SOME GENERAL PROPORTIONAL RELATIONSHIPS SUCH AS PERCENT OF SUPPORT EQUIPMENT WORKLOAD SPENT ON COMPONENTS FROM C^3I SYSTEMS, MEANTIME TO REPAIR, COST OF I OR D LEVEL LABOR, ETC.

TABLE 3. TYPICAL MLS FORCE OPERATING & SUPPORT COSTS (MILLIONS, FY80$) FISCAL YEAR BREAKOUT

	FISCAL YEAR						
	83	84	85	86-05	06	07	TOTAL
Number of Operating Units	50	100	150	150	100	50	-
Deliveries[1]	50	50	50	-	-	-	150
Unit Mission Personnel	6.4	19.3	32.1	771.0	25.7	12.9	867.4
Installation Support Personnel	1.2	3.5	5.8	138.0	4.6	2.3	155.4
*Subtotal (MILPERS)	$7.6	$22.8	$37.9	$909.0	$30.3	$15.2	$1022.8
Unit Level Consumption	1.8	5.5	9.1	219.0	7.3	3.7	246.4
Depot Level Maintenance	3.8	11.3	18.8	450.0	15.0	7.5	506.4
Indirect Personnel Support	0.7	2.0	3.4	81.0	2.7	1.4	91.2
Personnel Acquisition & Training	1.7	5.0	8.3	199.5	6.7	3.3	224.5
*Subtotal (O&M)	$8.0	$23.8	$39.6	$949.5	$31.7	$15.9	$1068.5
Sustaining Investment	0.5	1.4	2.3	54.0	1.8	0.9	60.9
*Subtotal (Procurement)	$0.5	$1.4	$2.3	$54.0	$1.8	$0.9	$60.9
*GRAND TOTAL	$16.1	$48.0	$79.8	$1912.5	$63.8	$32.0	$2152.2

[1] For costing purposes, it is assumed that a unit deployed in a given year incurs six months of operating costs in that year.

2. ASSUMPTIONS AND GROUND RULES

2.1 General.

The MLS is an existing system which, although not in wide use, has received FAA certification and is scheduled for installation at a great number of facilities. . . . In spite of the recent development, the MLS is based on well established solid state technology replacing the older vacuum tube technology . . . . The technical risks associated with this program are considered minimal. . . .

GUIDANCE: INCLUDE A GENERAL DESCRIPTION OF SYSTEM CHANGES AND DISCUSS THE ANTICIPATED IMPACTS ON O&S COSTS INDICATING THE DEGREE OF CONFIDENCE THAT THE CHANGES ARE PRACTICAL AND COST IMPACTS ARE ACCURATE.

2.2 Baseline System.

As in previous DSARC reports, the in-use PAR and ILS systems were used as a baseline. However, the data base was updated to include the latest year's data. The MLS will replace these systems when installed . . . .

GUIDANCE: IDENTIFY THE BASELINE SYSTEM AND EXPLAIN THE RATIONALE USED IN ITS SELECTION. IF THE BASELINE SYSTEM WAS CHANGED FROM DSARC II, EXPLAIN FULLY WHY THE CHANGE WAS NECESSARY.

2.3 System and Program Characteristics.

Table 4 illustrates system characteristics of the MLS. . . .

GUIDANCE: INCLUDE DETAILS OF THE PROPOSED SYSTEM. IF IT WOULD TEND TO CLARIFY ISSUES, INCLUDE CHARACTERISTICS OF THE BASELINE SYSTEM AS WELL.

TABLE 4. MLS SYSTEM CHARACTERISTICS
(Typical)

Mission: Landing System in conformance with International Standard

Range: 100 NM Radius

Weight: 16,400 lbs.

Power Usage: 44K Watts

Operational Life: 1983-2007

Deployments: 50 units per year beginning in 1983

Number of LRUs/System: . . . .

MTBF: . . . .

Maint hour/Radiating hour: . . . .

2.4 Assumptions, Model Inputs, and Rates.

2.4.1 Design Sensitive Values. Table 5 lists the elements that are design-related . . . .

TABLE 5. DESIGN SENSITIVE VALUES

Elements	Values	Source	OPR	EXT
1. Average Required Skill Level				
a. O Level Maint	E-5	Manpower Study	Jim Smith	75124
b. I Level Maint	E-7	Manpower Study	Jim Smith	75124
c. Operator	E-7	Manpower Study	Jim Smith	75124
2. Weight	16,400 lbs	Manufacturers Specifications	John Doe	73124
3. Power Usage	44 K Watts	Manufacturers Specifications	John Doe	73124
4. Voltage/AMPS	220 V/200A	Manufacturers Specifications	John Doe	73124
5. Availability	99.9%	PM Projection	John Doe	73124
6. Overhaul Cost	$350K/system	. . .	. . .	. . .
7. Set Up Time	15 min	Manufacturer Data	Jim Smith	75124

2.4.1.1 Required Skill Level

a. O Level Maint. The projections for the availability of 5 level skill personnel throughout the next . . . .

b. I Level Maint. I level skills will be confined to calibration and fault determination . . . .

2.4.1.2 Weight.

2.4.1.7 . . . .

GUIDANCE: DIVIDE VALUES USED IN THE COST ESTIMATING MODEL OR ALGORITHMS INTO TABLES DEPENDING ON THE NATURE OF THE PARAMETER INVOLVED.
TABLE 5 CONTAINS ELEMENTS WHICH ARE INHERENT TO THE SYSTEM DESIGN AND ARE DEPENDENT ON HARDWARE CONFIGURATION. FOLLOWING THIS TABLE IS A BRIEF EXPLANATION OF THE DERIVATION OF THE VALUE SELECTED FOR THE PARAMETER.

2.4.2 System Operational Standards.

Table 6 identifies the values used in this analysis which reflect current Air Force policy . . . .

TABLE 6. SYSTEM OPERATIONAL STANDARDS

Element	Value	Source	OPR	EXT
1. Radiating Rate	110 hr/wk	PM Projection	John Doe	73124
2. Overhaul Interval	96 mo	AF/LEX	Jack Smith	78192
3. Overhaul Duration	5.5 mo	AF/LEX	Jack Smith	78192
4. . . .	. . .	PM Projection	John Doe	73124

2.4.2.1 Radiating Rate.

In order to accommodate the flight training program and maintain proficiency with the MLS . . . .

2.4.2.2 Overhaul Interval.

The system modularity and solid state component make the MLS a highly dependable and durable . . . .

2.4.2.3 . . . .

GUIDANCE: LIST THOSE FACTORS ESTABLISHED BY THE USING COMMAND WHICH IMPACT O&S COSTS IN A TABLE. A BRIEF EXPLANATION AND DERIVATION OF THE VALUE SHOWN FOLLOWS THE TABLE.

2.4.3 Standard Values and Rates.

Table 7 lists the standard values and rates used and the source . . . .

TABLE 7. STANDARD VALUES AND RATES

Element	Value	Source	OPR	EXT
1. Energy Costs	$0.051/KWH	AFSC	Mary Doe	51234
2. Operators Composite Rate	$17,642	ASD (COMP) Memo	Bob Smith	55555
3. Maintenance Composite Rate	$15,123	ASD (COMP) Memo	Bob Smith	55555
4. System Service Life	25 years	ASD (COMP)	-	-
5. Escalation Factors	variable	ASD (COMP)	-	-
6. Base Year Dollars	FY 80	CAIG	Tom Mix	75631

GUIDANCE: HIGHLIGHT THOSE STANDARD VALUES WHICH ARE ESTABLISHED AND GENERALLY ACCEPTED IN A TABLE. THESE VALUES ARE NOT SUBJECT TO INFLUENCE BY THE SYSTEM UNDER CONSIDERATION OR THE USING COMMAND.

3. METHODOLOGY

3.1 General.

This analysis is based on the Air Force Cost and Planning Factors, which were utilized for manpower and related costs, and an analysis of user maintenance data.

GUIDANCE: IF A GENERALLY APPLICABLE COMPUTERIZED COST ESTIMATING MODEL IS USED FOR THE ANALYSIS INSTEAD OF THE SERIES OF ALGORITHMS LISTED IN APPENDIX B OF THIS REPORT, INCLUDE SUMMARY OF THE MODEL USED, AS WELL AS APPROPRIATE COMPUTER PROUCTS, IN APPENDIX C OF THE REPORT AND OMIT APPENDIX B.

3.2 Data Sources.

The sources used in defining the baseline costs and the method used in estimating the proposed system's cost are listed in Table 8 for each of the cost elements . . . .

GUIDANCE: THE METHODOLOGY SELECTED IS DEPENDENT ON THE COSTING REQUIREMENTS AND THE AVAILABLE DATA.

3.3 Derivation of Estimators.

In applying the baseline data to the MLS and projecting costs it was necessary to establish a proportional relationship between the MLS and the PAR/ILS. These proportions are explained in the following paragraphs.

GUIDANCE: ESTABLISH SOME PROPORTIONAL RELATIONSHIP BETWEEN THE EXISTING SYSTEMS AND THE ALTERNATIVES WHEN COST ANALYSIS DATA IS NOT DIRECTLY AVAILABLE FROM THE WEAPON SYSTEM UNDER CONSIDERATION. THIS RELATIONSHIP IS THEN USED TO SCALE THE BASELINE COSTS TO DETERMINE THE ESTIMATED COSTS OF THE ALTERNATIVE SYSTEMS.

TABLE 8. DATA SOURCES AND METHODOLOGY

Cost Element	PAN/ILS BASELINE Source	PAN/ILS BASELINE Method Existing Data:	MLS ALTERNATIVE SYSTEM Source	MLS ALTERNATIVE SYSTEM Method
UNIT MISSION PERS	USAF Cost & Planning Factors	Normalized to Grade Level	Baseline	Scaled by Manpower
UNIT LEVEL CONSUMPTION				
ENERGY	O&M Cost of Flight Facilities	Normalized to Cost/ System/Year	Baseline	Scaled by breakdown and reliability trend factors.
Maint Material	O&M Cost of Flight Facilities	Normalized to Cost/ System/Year	Baseline	Scaled by breakdown and reliability trend factors
DEPOT LEVEL MAINT				
Component Repair	O&M Cost of Flight Facilities	Normalized to Cost/ System Year	Baseline	Scaled by breakdown and reliability trend factors
Contracted Unit Level Spt	O&M Cost of Flight Facilities	Normalized to Cost/ System/Year	Baseline	Scaled by breakdown and reliability trend factor
SUSTAINING INVESTMENT				
Repairable Spares	O&M Cost of Flight Facilities	Normalized to Cost/ System/Year	Baseline	Scaled by breakdown and reliability trend factor
INSTALATION SPT PERS				
BOS	USAF Cost & Planning Factors	Normalized to Cost Factor based on Squadron size	Baseline	Scaled by Manpower
RPMI	USAF Cost & Planning Factors	Normalized to Cost Factor based on Squadron size	Baseline	Scaled by Manpower
Medical	USAF Cost & Planning Factors	Normalized to Cost Factor based on Squadron size	Baseline	Scaled by Manpower
INDIRECT PERS SPT				
Misc Ops Maint	USAF Cost & Planning Factors	Normalized to Cost/ Man Year	Baseline	Scaled by Manpower
Medical O&M	USAF Cost & Planning Factors	Normalized to Cost/ Man Year	Baseline	Scaled by Manpower
PCS	USAF Cost & Planning Factors	Normalized to Cost/ Man Year	Baseline	Scaled by Manpower
PERS. ACQUISITION & TRNG				
Acquisition	USAF Cost & Planning Factors	Normalized to Cost/ Man Year	Baseline	Scaled by Manpower
Individual Trng.	USAF Cost & Planning Factors	Normalized to Cost/ Man Year	Baseline	Scaled by Manpower

It should be noted that this methodology for this example relied heavily upon allocations for support costs which are based on crew size. Similar scaling methods can be used to measure a substantial number of factors such as changes in weight, reliability, operations hours, etc.

3.3.1 Reliability and Maintainability.

In consonance with the level of detail available on this program, Reliability and Maintainability (R&M) data is provided . . . .

3.3.1.1 Electronics.

The MLS is composed of 100% solid state modular electronics. This is expected to reduce the maintenance requirements. However, the extremely long mean time between failure of any one component makes it impractical to establish a intermediate level repair, therefore . . . .

3.3.1.2 Overhaul.

Periodically, it will be necessary to upgrade cable runs, antenna footings, etc . . . .

GUIDANCE: MANY OF THE ALTERNATIVE SYSTEM O&S COSTS WHICH CANNOT BE OBTAINED DIRECTLY MAY BE ESTIMATED BY DETERMINING THEIR RELATIONSHIP TO THE TOTAL COSTS OF THE BASELINE SYSTEM. THEREFORE, IT IS OFTEN HELPFUL TO ESTABLISH A RELATIONSHIP BETWEEN THE BASELINE COSTS AND THE ESTIMATE OF THE ALTERNATIVE'S FACTOR COSTS.

THE AVAILABLE DATA AGGREGATES THE MAINTENANCE CATEGORIES INTO ONE ENTITLED SUPPLIES. FOR DSARC III PURPOSES, SCALING SUCH A COMPOSITE COST SHOULD BE AVOIDED IN FAVOR OF THE FOLLOWING PROCEDURE WHICH TRACKS EACH FACTOR DRIVING A COST IN ISOLATION.

THE EXISTING PAR/ILS SYSTEM CONSISTS OF RADARS, TOWER, DISPLAYS, TOWER AUDIO COMMUNICATION EQUIPMENT, AND AIRCRAFT RECEIVING EQUIPMENT. THE MLS WILL INCLUDE AUTOMATIC TOWER COMMUNICATIONS EQUIPMENT AND ENHANCED AIRCRAFT RECEIVING EQUIPMENT. THE AIRCRAFT EQUIPMENT COST WILL BE CAPTURED IN THE M/D/S OR T/M/S UNDER RETROFITTING OR ENHANCEMENT. THE REMAINING SYSTEMS COSTS CAN BE ESTIMATES THROUGH UTILIZATION OF DATA REQUESTED FROM OPERATORS. THE REMAINING COSTS ARE BROKEN DOWN INTO

RADAR AND DISPLAYS WHICH ARE SCALED ACCORDING TO SOLID STATE FACTORS, PLUS COMMUNICATIONS WHICH IS COSTED BY AN ENGINEERING ESTIMATE BECAUSE IT REPRESNETS AN ADDED CAPABILITY.

IN THE COST ELEMENT STRUCTURE OF THESE EXAMPLES, MAINTENANCE COSTS FALL INTO SEVERAL ELEMENTS: UNIT LEVEL CONSUMPTION, DEPOT LEVEL MAINTENANCE, SUSTAINING INVESTMENT AND DEPOT NON-MAINTENANCE. SINCE THE CURRENT NON-AUTOMATIC SYSTEM UTILIZES TUBES, AND THE NEW SYSTEM IS AUTOMATIC AND SOLID STATE, CERTAIN TRENDS CAN ONLY BE DETERMINED FROM ENGINEERING ANALYSIS AND TESTING. A HYPOTHETICAL EXAMPLE OF THESE TRENDS IS SHOWN IN THE CHARTS IN APPENDIX B ALONG WITH THE DERIVATION OF THE SCALING FACTOR AND NEW SYSTEM COST.

4. Sensitivity Analysis.

Although the MLS has completed development, it has not been deployed, and although sufficient detail is known to establish relatively accurate predictions . . . .

GUIDANCE: RUN SENSITIVITY ANALYSES ON COST ELEMENTS WHICH VARY ACCORDING TO RELIABILITY, MAINTAINABILITY, UNIT COST, ETC. WHEN A COST IS VARIED, PRESENT AND EXPLAIN THE MAJOR ASSOCIATED CHANGES TO OTHER COST ELEMENTS. THIS IS PARTICULARLY SIGNIFICANT WITH MEASURES SUCH AS RELIABILITY AND MAINTAINABILITY WHERE A CHANGE IN EQUIPMENT PERFORMANCE CAN LEAD TO CHANGES IN MANPOWER REQUIRED TO MAINTAIN THE EQUIPMENT, AS WELL AS TO OPERATE THE BASE.

ITEMS WHICH HAVE RAPIDLY RISING PRICES OR MAJOR COSTS TO THE SYSTEM ARE LIKELY TO BE CANDIDATES FOR SENSITIVITY ANALYSIS.

One area of concern is energy cost, which was analyzed by utilizing current cost plus the present 1983 and potential projections.

Kilowatt Consumption:

44 KW/HR x 110 HR/WK x 52 WK/YR = 251,680 KWH/YR

GUIDANCE: WHEN THE CHANGES HAVE SIGNIFICANT COST IMPACT, THE MAGNITUDE OF COSTS SHOULD BE PRESENTED IN AN APPROPRIATE MANNER. SOME EXAMPLES ARE: TABULARLY WITH X% COST VARIATIONS, GRAPHICALLY WITH COST BOUNDARIES, ACTUAL COST VARIATIONS VS. COST VARIATION NEEDED TO CHANGE THE TOTAL COST BY X%, ETC.

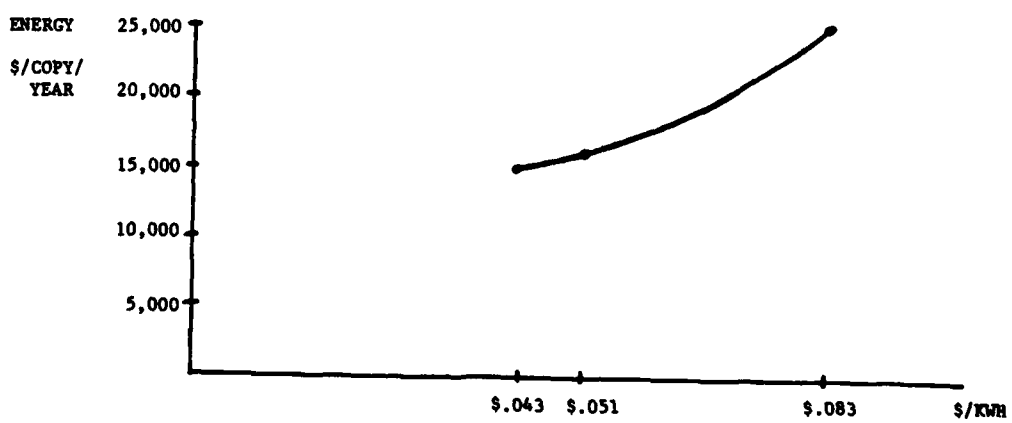
TABLE 9

SENSITIVITY ANALYSIS

	CURRENT COST	PRESENT 1983 PROJECTION	POTENTIAL PROJECTION
	$.043/KWH	$.051/KWH	$.083.KWH
KILOWATT CHARGE (Fixed)	$4250	$4250	$4250
KILOWATT HOUR CHARGE (Variable)	251,680 KWH x $ .043/KWH $10,822/YR	251,680 KWH x $ .061/KWH $12,836/YR	251,680 KWH x $ .083/KWH $20,889/YR
TOTAL ENERGY COST	$15,072	$17,086	$25,139

FIGURE 2. ENERGY COST SENSITIVITY GRAPH

(FY80 $/COPY/YEAR)



5. Summary.

At DSARC II, the following issues were unresolved . . . .

GUIDANCE: NOTE SOLUTION TO ALL UNRESOLVED QUESTIONS FROM DSARC II. POINT OUT THE AGENCY AND METHOD BY WHICH COSTS WILL BE MONITORED ONCE DEPLOYED.

APPENDIX A. PERSONNEL

A. General

Ground based landing systems of necessity must vary in their manning requirements according to several factors including parent command, location, and traffic load. Therefore, to estimate manpower requirements, several bases of the major USAF Commands were surveyed to ascertain a representative ILS/PAR work force. It was determined that a contingent of 46 people was a median sized operations and maintenance contingent.

GUIDANCE: EXPLAIN THE RATIONALE BEHIND MANNING CHANGES TO THE BASELINE SYSTEM. WHEN THE ALTERNATIVE SYSTEM INCORPORATES NEW CONCEPTS OR A RADICAL DEPARTURE FROM EXISTING SYSTEMS/METHODS, EXPLAIN IN DETAIL THE CHANGE AND ITS EXPECTED IMPACT ON MANNING.

A.1 Operators

Since the MLS is automatic, no operators will be required . . . .

A.2 Maintenance

. . . Furthermore, expected improvements in reliability and maintainability have allowed the program managers to set a goal of 14 maintenance supervisors and personnel with a threshold of 20. This change in maintenance workload will further allow the elimination of all civilian personnel requirements of the present PAR/ILS system which furthers the USAF goal of increasing the combat readiness and deployability of the MLS.

GUIDANCE: INCLUDE A DETAILED NARRATION OF FACTORS THAT IMPINGE ON MAINTENANCE MANNING AS A WHOLE, SUCH AS CAPACITY OF FACILITIES, THROWAWAY VS. REPAIR IMPACT, AND MAINTENANCE CONCEPT.

A.3 Support Personnel

The projected workforce reductions are expected to yield a further reduction of 50% of the support personnel in the grades E-1 to E-6, which are allocated to the MLS.

GUIDANCE: INCLUDE REASONS FOR EACH CHANGE IN MANNING TO THE LEVEL OF DETAIL KNOWN.

APPENDIX B. MATHEMATICAL COMPUTATIONS

(All results in Thousands)

GUIDANCE: MATHEMATICAL COMPUTATIONS AND FORMULAS/ALGORITHMS LISTED IN APPENDIX B SHOULD NOT BE DUPLICATED IN APPENDIX C. NORMALLY, WHEN APPENDIX B IS USED APPENDIX C IS OMITTED.

PAR/ILS BASELINE	MLS
UNIT MISSION PERSONNEL	
Operators	
Operators x rate = operator costs 15 x $17,642 =$265K	No Operators Required
Maintenance	
Maint Personnel x rate = Maint Personnel Costs 30 x $15,123 =$454K	Maint personnel x rate = Maint personnel costs 14 x $15,123 = $212K
Support Personnel	
Examination of representative bases indicates that 7 support personnel are required for PAR/ILS 7 x $15,123 =$106K	Engineering analysis indicates that lower manpower requirements of MLS reduce supervisors needed to 3. 3 x $15,123 =$45K

INSTALLATION SUPPORT PERSONNEL

USAF Cost & Planning Factors allocate these factors (BOS, RPM and Medical) in terms of manpower per flying squadron. One sample aircraft was taken for each Major Air Command. The manpower per squadron was recorded and the factor computed as shown in Table B.1. For specific data, see AFP 173-13, dated 1 February 1980, Table 30, page 98-100, Selected Typical Aircraft Squadron Strength.

TABLE B.1 INSTALLATION SUPPORT
PERSONNEL COST FACTOR DERIVATION

		BOS		RPM		MEDICAL	
	PPE	PERSONS	%	PERSONS	%	PERSONS	%
SAC	728	103	14	12	2	9	1
TAC	494	66	13	8	2	5	1
PAC	669	92	14	11	2	12	2
AFE	568	84	15	10	2	13	2
MAC	829	132	16	16	2	16	2
AVE % OF MISSION PERS.			14.4		2		1.6

PAR/ILS BASELINE MLS

BOS

Percent of mission personnel x unit mission personnel cost = BOS Cost

.144 x 825 = $119K .144 x 257 = $37K

Real Property Management

Percent of mission personnel x unit mission personnel cost = RPM Cost

.02 x 825 = $17K .02 x 257 = $5K

Medical

Percent of mission personnel x unit mission personnel cost = Medical Cost

.016 x 825 = $13K .016 x 257 = $4K

INDIRECT PERSONNEL SUPPORT

Miscellaneous Operations & Maintenance

Cost factor x number of personnel = Miscellaneous O&M Cost

$988 x 52 = $51.5K $988 x 17 = $17K

Medical O&M (Non Pay)

Cost factor x number of personnel = Medical O&M cost

$201 x 52 = $10.5K $201 x 17 = $3.5K

PCS

Cost factor x number of officers = PCS (Officers) cost

$1051 x 5 = $5K $1051 x 1 = $1K

Cost factor x number of enlisted personnel = PCS (Enlisted) Cost

$335 x 47 = $15.5K $335 x 16 = $5.5K

Temp Additional Duty Pay

Not Applicable Not Applicable

PERSONNEL ACQUISITION & TRAINING

Acquisition

Cost factor x turnover rate x number of officers = Acquisition cost (off)

$10270 x .135 x 5 = $7K $10270 x .135 x 1 = $1.5K

Cost factor x turnover rate x number of enlisted personnel = acquisition cost (Enl)

$3570 x .135 x 47 = $22.5K $3570 x .135 x 16 = $7.5K

Individual Training

Cost factor x turnover rate x number of personnel = Ind. train. cost

$25141 x .135 x 52 = $176.5K $25141 x .135 x 17 = $57.5K

TABLE B.2 MLS ESTIMATE

RADAR & DISPLAYS

	Expected Trend with New System	Scaling Factor	Percent of Current System Cost (Total System)	New System Cost
Unit Level Consumption				
Energy	down	0.6	10%	$12,000
Maintenance Material	unit cost up frequency down	1.3 x .5 = .65	40%	$52,000
Depot Level Maintenance				
Equipment Overhaul[1]	-	-	0%*	-
Component Repair	unit cost up frequency down	1.8 x .5 = .9	25%	$45,000
Support Equipment	-	-	0%*	-
Contract Unit Level Support	unit cost up frequency down	1.5 x .5 = .75	20%	$30,000
Modification	-	-	-	-
Sustaining Investment				
Repairable Spares	unit cost up frequency down	1.6 x .5 = .80	5%	8,000
				$147,000

1 See Contract Unit Level Support

TABLE B.3 . MLS ESTIMATE

COMMUNICATIONS EQUIPMENT

	System Cost Estimate
Unit Level Consumption	
Energy	5,000
Maintenance Materials	4,000
Depot Level Maintenance	
Contract Unit Level Support	25,000
Component Repair	50,000
Sustaining Investment	
Repairable Spares	10,000
	94,000

*Depot functions will be contracted out with MLS. Move depot costs to contractor for scaling purposes.

TABLE B.4 PAR/ILS BASELINE

	Radar & Displays	Communications
Unit Level Consumption		
Energy	$20,000	$6,000
Maintenance Material	$80,000	$3,000
Depot Level Maintenance		
Equipment Overhaul	-	-
Component Repair	$50,000	$35,000
Support Equipment	-	-
Contract Unit Level Support	$40,000	$10,000
Modification	-	-
Sustaining Investment		
Repairable Spares	$10,000	$ 7,000
TOTAL	$200,000	$61,000


DATE
ILME